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MAJOR ARTICLE

Incidental Findings on Coronary Computed Tomography Angiography in Human Immunodeficiency Virus (HIV)-Positive and HIV-Negative Persons

Sara Reinschmidt,[1,a] Teja Turk,[1,2,a] Philip E. Tarr,[3] Roger Kouyos,[1,2] Christoph Hauser,[4] Patrick Schmid,[5] Rainer Weber,[1] Philipp Kaufmann,[6] Ronny R. Buechel,[6] Helen Kovari,[1]; and the Swiss HIV Cohort Study

[1]Division of Infectious Diseases and Hospital Epidemiology, University Hospital, Zurich, University of Zurich, Switzerland; [2]Institute of Medical Virology, University of Zurich, Switzerland; [3]University Department of Medicine and Division of Infectious Diseases and Hospital Epidemiology, Kantonsspital Baselland, University of Basel, Bruderholz, Switzerland; [4]Department of Infectious Diseases, Bern University Hospital, University of Berne, Switzerland; [5]Division of Infectious Diseases, Cantonal Hospital, St. Gall, Switzerland; [6]Department of Nuclear Medicine, Cardiac Imaging, University Hospital Zurich, University of Zurich, Switzerland

Background. Incidental findings on coronary computed tomography angiography (CCTA) have a great impact on the benefits and costs of testing for cardiovascular disease. The number of incidental findings might be increased in human immunodeficiency virus (HIV)-positive individuals compared with the general population. Data are limited regarding the association between incidental findings and HIV infection.

Methods. We assessed the prevalence and factors associated with incidental findings among HIV-positive and HIV-negative participants ≥45 years undergoing CCTA. Logistic regression was performed to evaluate the factors associated with incidental findings in the HIV-positive and HIV-negative groups. For the analysis of the HIV effect, a propensity score-matched dataset of HIV-positive/HIV-negative participants was used.

Results. We included 553 participants, 341 with and 212 without HIV infection. Incidental findings were observed in 291 of 553 (53%) patients. In 42 of 553 (7.6%) participants, an incidental finding resulted in additional workup. A malignancy was diagnosed in 2 persons. In the HIV-positive group, age (1.31 per 5 years, 1.10–1.56) and smoking (2.29, 1.43–3.70) were associated with incidental findings; in the HIV-negative group, age (1.26, 1.01–1.59) and a CAC score >0 (2.08, 1.09–4.02) were associated with incidental findings. Human immunodeficiency virus seropositivity did not affect the risk of incidental findings.

Conclusions. Incidental findings were highly prevalent among HIV-positive and HIV-negative persons. Human immunodeficiency virus infection was not associated with an increased risk of incidental findings.

Keywords: coronary CT angiography; HIV; incidental findings.

Because coronary computed tomography angiography (CCTA) is an increasingly used imaging modality for early detection of subclinical atherosclerosis in human immunodeficiency virus (HIV)-positive individuals, it is of substantial importance to have reliable data on the prevalence of incidental findings during CCTA imaging, their clinical significance, and associated factors.

Incidental findings have a great impact on the cost effectiveness of imaging procedures such as the CCTA and might lead to changes in clinical management. Moreover, the emotional impact on patients by worry regarding malignancy should be taken into account.

Persons who are HIV-positive may be at increased risk of age-related diseases including nonacquired immune deficiency syndrome-associated cancers, osteoporotic fractures, myocardial infarction, and chronic kidney and liver disease compared with the general population of the same age [1]. Human immunodeficiency virus-induced chronic immune activation, persistent low-grade inflammation, and lifestyle-related factors, including a high prevalence of nicotine consumption [2, 3], are discussed as contributors. Thus, the number of incidental findings noted on cardiac computed tomography (CT) might be increased in HIV-positive individuals compared with the general population.

Several studies have assessed the frequency and types of incidental findings among the general population during CCTA and other imaging modalities [4–10]. Although a few studies investigated the prevalence of incidental findings in HIV-positive cohorts [11–13], no study has been performed to date comparing incidental findings on CCTA in an HIV-positive with an HIV-negative population.

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[a]S. R. and T. T. contributed equally to this manuscript.

Correspondence: H. Kovari, MD, Division of Infectious Diseases and Hospital Epidemiology, University Hospital Zurich, University of Zurich, Rämistrasse 100, CH-8091 Zurich, Switzerland (helen.kovari@usz.ch).

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Therefore, the purpose of this study was to (1) describe the prevalence and types of incidental findings among HIV-positive and HIV-negative study participants, (2) explore the association with demographic and clinical factors, including HIV infection, and (3) determine the parameters that are associated with the occurrence of incidental findings in the HIV-positive group.

METHODS

Study Design and Study Participants

In this substudy, we evaluated 553 persons with and without HIV infection participating in a CCTA study, investigating the prevalence of subclinical coronary artery disease (CAD) using CCTA and noncontrast CT scan for coronary artery calcification (CAC) scoring. Participants were enrolled between October 2013 and July 2016 at the University Hospital Zurich, Switzerland. The inclusion criteria were age ≥45 years, no documented CAD or stroke, glomerular filtration rate ≥60 mL/minute, no allergy to iodinated contrast agent, and no irregular heartbeat. All HIV-positive persons were participants of the Swiss HIV Cohort Study (SHCS). The HIV-uninfected participants were referred for CCTA to the University Hospital of Zurich during the enrollment period. By periodical comparisons of the 2 groups with regard to age, gender, and Framingham risk score and adjusting the selection criteria for the HIV-negative individuals, we attempted to include comparable populations.

Data Collection

For HIV-positive participants, clinical and laboratory data were collected within the SHCS. In this ongoing, prospective cohort study, demographic, clinical, and laboratory data are collected at registration and every 6 months thereafter using a standard protocol including detailed information on CAD events, arterial hypertension, diabetes mellitus, nicotine, alcohol, intravenous drug use (IDU), and medication [14]. For HIV-negative participants, clinical information was obtained using a structured questionnaire that included comorbidities, smoking, alcohol, drug use, and current medication. The data on the clinical workup and treatment of incidental findings were assessed retrospectively by reviewing the clinical charts of the CCTA study participants. The protocol was approved by the local ethical review board (Kantonale Ethik-Kommission Zürich, BASEC-Nr. 2016-01004). Written informed consent was obtained from all participants.

Computed Tomography Acquisition and Image Analysis

All CCTA/CAC imaging studies were performed at the University Hospital Zurich. Computed tomography contrast imaging was completed using a 64-slice Discovery 750 HD or 256-slice Revolution CT scanner (both from GE Healthcare, Waukesha, WI) with a prospectively electrocardiography-triggered cardiac acquisition protocol (SnapShot Pulse, GE) with tube voltage (80–120 kVp) and current (115–640 mA) adapted to body mass index (BMI). Imaging was done at a temporal resolution of 83 to 175 msec with either a step-and-shoot scan mode (64-slice scanner) or a single-beat-acquisition mode (256-slice scanner). Slice thickness was 0.625 mm. A BMI-adapted contrast protocol (Visipaque 320, GE Healthcare) was applied (25–105 mL at 3.5–5.0 mL/second). To ensure optimal interpretability of the coronary arteries, all patients received 2.5 mg of sublingual isosorbide dinitrate, and, if needed, up to 30 mg of metoprolol was injected intravenously to reach a target heart rate of <65 beats/minute. The field of view was set to cover the entire heart and included, at least partially, the mediastinum, aorta, lungs, pleura, lung hila, diaphragm, spine and ribs, liver, spleen, adrenal glands, and colon. The cardiac findings were assessed by 2 experienced readers of the Cardiac Imaging Division, and the incidental extracardiac findings were assessed by a board-certified radiologist at the University Hospital Zurich in addition.

Definitions

Findings were defined as incidental if not previously known. A finding was deemed to be significant if medical referral or radiological workup was recommended. The radiologist's assessment regarding the need for additional workup was determined by evidence-based criteria according to current radiology guidelines as described previously [4–6]. Pulmonary nodules were rated as relevant according to the Fleischner Society Guidelines [15]. Arterial hypertension was defined as systolic or diastolic blood pressure ≥40 mmHg/≥90 mmHg or use of antihypertensive medication. Diabetes was diagnosed in participants with plasma glucose levels of >7.0 mmol/L (fasting) and >11.1 mmol/L (nonfasting) or receiving antidiabetic medication. Data on alcohol consumption were collected by using the alcohol screening test, Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) [16].

Statistical Analysis

Patients' characteristics between the groups of patients with and without incidental findings were compared using the *P* values from the Fisher's exact test and Wilcoxon rank-sum test. Characteristics with a *P* value <.05 were included in a multivariate logistic regression model along with other clinically and epidemiologically relevant factors and confounders. To identify the risk factors associated with incidental findings in the HIV-positive and HIV-negative population, multivariable regressions were performed in the 2 groups separately. To finally assess the role of HIV infection as an effect modifier, an analysis in the entire population (including both HIV-positive and HIV-negative individuals) with HIV status included in interaction terms was performed. To assess the association between HIV infection and incidental findings, 1:1 propensity score matching between cases and controls was carried out. Age, gender, coronary calcification, hypertension, current smoking, alcohol consumption, and BMI were used as predictors for the propensity score. The matching resulted in a homogeneous (with respect

to the baseline characteristics [see Supplementary Table 3]) dataset consisting of 151 cases and 151 controls. A conditional logistic regression with HIV infection as covariate was fitted to the matched dataset to estimate the effect of HIV infection on incidental findings. The HIV-specific determinants of incidental findings in the HIV-infected population were identified similarly as outlined above and examined with multivariate logistic regression on all HIV-positive individuals. Patients with missing information on risk factors were not included in the model fitting. The analyses were performed in R (using stats, matching, and survival packages).

RESULTS

Study Population

A total of 553 persons, 341 with and 212 without HIV infection, were included. Their characteristics at time of cardiac imaging are shown in Table 1.

Among the HIV-positive participants (median age 52 years, 88% men, men who have sex with men 64%, IDU 9.4%), 35% were current smokers, and 55% had a CAC score >0. Their median duration of HIV infection was 15 years, median CD4 cell count at the time of CCTA was 603 cells/μL, and 93% were on antiretroviral therapy (ART) with suppressed viral load in 95%. Human immunodeficiency virus-positive individuals with incidental findings were older, more likely to be current smokers, with a higher Framingham risk score, and had a longer duration of HIV infection and years on ART (Supplementary Table 1).

The HIV-negative control group (median age 56 years, 77% men) consisted of 15% smokers; they had hypertension in 61% and a CAC score >0 in 61%. Human immunodeficiency virus-negative controls with incidental findings compared with those without incidental findings were older, more likely to have hypertension, a CAC score >0, and a higher Framingham risk score (Supplementary Table 2).

Prevalence of Incidental Findings

In 291 of 553 (53%) of all participants, an incidental finding was noted. In 116 persons, more than 1 incidental finding was found. Overall, 452 incidental findings were detected; they were most often in the lungs, followed by bone and the abdomen (Table 2).

In the HIV-positive group, in 164 of 341 (48%) participants, unexpected findings were diagnosed, most commonly in the lungs (59% of all incidental findings), consisting mostly of noncalcified and calcified nodules, emphysema, atelectasis, and scarring. In the HIV-negative comparison group, in 127 of 212 (60%) patients, incidental findings were detected (48% pulmonary, 23% abdominal, 20% bone abnormalities).

In 42 of 553 (8%) of all participants, an incidental finding was rated as clinically relevant requiring follow-up or medical

Table 1. Baseline Characteristics of Human Immunodeficiency Virus (HIV)-Positive and HIV-Negative Participants

		HIV Status		
All Patients	All Patients	Negative	Positive	*P* Value
Total number of patients, n (%)	553	212 (38%)	341 (62%)	
Sex, n (%)				<.001
Male	463 (84%)	163 (77%)	300 (88%)	
Age [years], median (IQR)	54 (50–60)	56 (51–62)	52 (49–57)	<.001
Body mass index [kg/m^2], median (IQR)	25.3 (23.1–28.1)	26.0 (23.7–28.7)	24.9 (22.7–27.8)	<.001
Body mass index category, n (%)				<.001
23.5–27	201 (36%)	76 (36%)	125 (37%)	
≤23.5	157 (28%)	42 (20%)	115 (34%)	
≥27	194 (35%)	93 (44%)	101 (30%)	
Diabetes mellitus, n (%)				.220
Yes	26 (4.7%)	13 (6.1%)	13 (3.8%)	
Arterial hypertension, n (%)				<.001
Yes	243 (44%)	130 (61%)	113 (33%)	
Current smoking, n (%)				<.001
Yes	150 (27%)	32 (15%)	118 (35%)	
Active intravenous drug use, n (%)				.016
Yes	10 (1.8%)	0 (0.00%)	10 (2.9%)	
Alcohol consumption, n (%)				.011
None/mild	415 (75%)	140 (66%)	275 (81%)	
Moderate	106 (19%)	50 (24%)	56 (16%)	
Severe	4 (0.72%)	0 (0.00%)	4 (1.2%)	
CAC score > 0, n (%)				.129
Yes	317 (57%)	129 (61%)	188 (55%)	
Framingham CHD score, median (IQR)	9.4 (5.7–14.2)	9.3 (5.7–13.8)	9.4 (5.7–14.4)	.815

Abbreviations: CAC, coronary artery calcification; CHD, coronary heart disease; IQR, interquartile range.

Table 2. Number and Type of Incidental Findings on Coronary Computer Tomography Scans of 341 Human Immunodeficiency Virus (HIV)-Positive and 212 HIV-Negative Participants

	HIV Status		
	Negative	Positive	
Location of Incidental Findings	(n = 212)	(n = 341)	Total
Lung	99 (48%)	145 (59%)	244 (54%)
Parenchymal/ Bronchi	96	140	236
Nodules >10 mm	1	5	6
Calcified nodules <10 mm	11	12	23
Noncalcified nodules <10 mm	44	39	83
Pneumonia	0	1	1
Scarring	1	10	11
Emphysema	4	25	29
Atelectasis	17	25	42
Bronchiectasis	2	2	4
Parenchymal opacity/Consolidation	9	8	17
Bronchitis/Bronchial thickening	0	4	4
Cysts	1	4	5
Bullae	6	5	11
Pleura	*3*	*5*	*8*
Thickening	1	2	3
Effusion	0	1	1
Calcification	2	1	3
Retraction hemithorax	0	1	1
Diaphragm	3 (1%)	4 (2%)	7 (2%)
Diaphragmatic hernia	3	1	4
Diaphragmatic elevation	0	3	3
Cardiac	2 (1%)	4 (2%)	6 (1%)
Persistent foramen ovale	1	3	4
Atrial septal defect	1	1	2
Mediastinum	14 (7%)	18 (7%)	32 (7%)
Lymph nodes	9	5	14
Aortic ectasia/aneurysm	4	12	16
Thymus mass	1	1	2
Abdomen	47 (23%)	33 (13%)	80 (18%)
Liver	*33*	*21*	*54*
Gall bladder stone	0	2	2
Calcification	4	1	5
Steatosis	7	2	9
Hypodense lesion	22	16	38
Spleen	*2*	*5*	*7*
Calcification	1	0	1
Accessory spleen	1	3	4
Splenomegaly	0	2	2
Adrenal tumor/calcification	*1*	*2*	*3*
Oesophagus hernia	*10*	*5*	*15*
Others: Chilaidity-Syndrome	*1*	*0*	*1*
Breasts	0	0	0
Bone, soft tissue	40 (20%)	43 (17%)	83 (18%)
Rib fracture (healed)	*5*	*6*	*11*
Scoliosis	*0*	*1*	*1*
Spondylosis	*30*	*25*	*55*
Schmorl's nodes	*4*	*4*	*8*
Osteochondrosis	*1*	*1*	*2*
Morbus Forestier	*0*	*1*	*1*
Vertebral hemangioma	*0*	*3*	*3*
Lipoma	*0*	*2*	*2*
Total incidental findings	205 (100%)	247 (100%)	452 (100%)

The numbers correspond to the number of incidental findings.

Table 3. Number and Type of Clinically Relevant Incidental Findings on Coronary Computer Tomography Scans of 341 Human Immunodeficiency Virus (HIV)-Positive and 212 HIV-Negative Participants

	HIV Status		
	Negative	Positive	
	(n = 212)	(n = 341)	Total
Lung	15 (68%)	18 (60%)	33 (64%)
Parenchymal/Bronchi	*15*	*18*	*33*
Noncalcified nodules <10 mm	10	10	20
Nodules >10 mm	0	5	5
Calcified nodules <10 mm	2	0	2
Emphysema	1	1	2
Parenchymal opacity/Consolidation	2	0	2
Scarring	0	1	1
Bullae	0	1	1
Mediastinum	2 (9.1%)	7 (23%)	9 (17%)
Lymph nodes	1	1	2
Aortic ectasia/aneurysm	1	6	7
Abdomen	5 (23%)	4 (13%)	9 (17%)
Liver	*5*	*4*	*9*
Hypodense lesion	4	3	7
Calcification	1	0	1
Steatosis	0	1	1
Bone, soft tissue	0 (0.0%)	1 (3.3%)	1 (1.9%)
M Forestier	*0*	*1*	*1*
Total clinically relevant findings	22 (100%)	30 (100%)	52 (100%)

The numbers correspond to the number of incidental findings.

referral. In the HIV-positive group, 30 of 341 (9%) patients had clinically relevant incidental findings; in the HIV-negative group, 22 of 212 (10%) patients had clinically relevant incidental findings (Table 3). Investigations revealed a malignancy in 2 HIV-positive participants, including a lymphoma and pancreatic cancer with pulmonary metastases. In a third HIV-positive patient, the detection of a suspicious pulmonary nodule resulted in a wedge resection. Histology revealed no malignancy but an aspergilloma.

Associations Between Clinical Variables and Incidental Findings in Human Immunodeficiency Virus (HIV)-Positive and HIV-Negative Persons

Univariable and multivariable analyses of factors contributing to incidental findings are shown in Figure 1. In the HIV-positive group, age (odds ratio [OR], 1.31 per 5 years; 95% confidence interval [CI], 1.10–1.56) and smoking (OR, 2.29; 95% CI, 1.43–3.70) were significantly associated with incidental findings, whereas in the HIV-negative group, age (OR, 1.26 per 5 years; 95% CI, 1.01–1.59) and a CAC score >0 (OR, 2.08; 95% CI, 1.09–4.02) were associated with incidental findings (Figure 1). In a propensity score-matched dataset of HIV-positive and HIV-negative participants, HIV seropositivity did not increase the prevalence of incidental findings (Figure 2). These findings were additionally confirmed in a multivariable logistic regression model, where interactions between HIV serostatus and risk factors were included (Supplementary Figure 1).

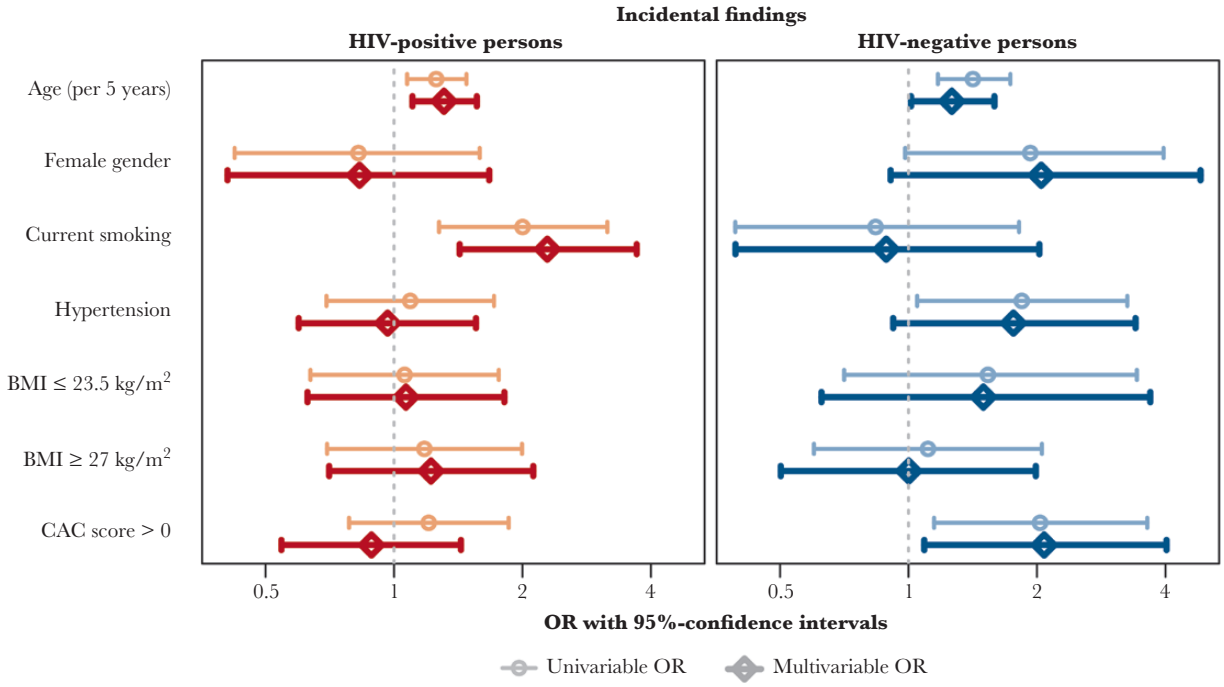

Figure 1. Associations between demographic and clinical variables and incidental findings stratified for human immunodeficiency virus (HIV) status. The multivariate logistic regression analyses including all covariates listed on the left side were carried out separately for all 341 HIV-positive persons with 247 incidental findings (left panel) and all 212 HIV-negative persons with 205 incidental findings (right panel). BMI, body mass index; CAC, coronary artery calcification; OR, odds ratio.

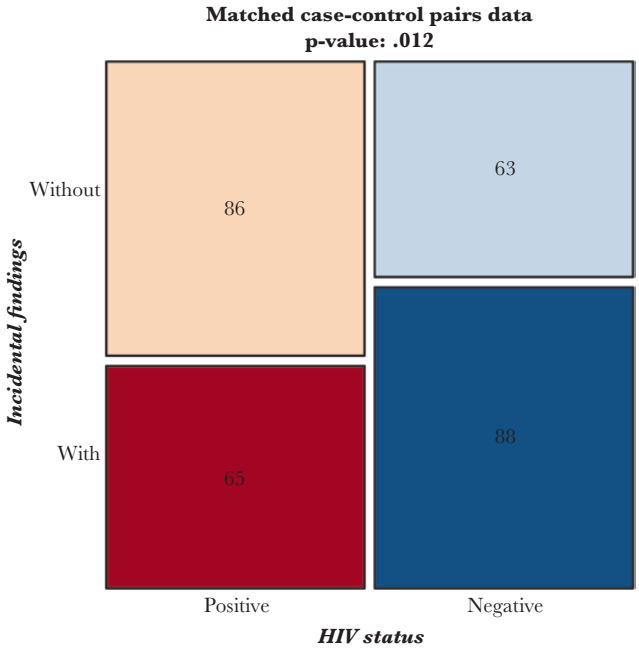

Figure 2. The 1:1 case-control propensity score matching. The propensity scores were calculated based on age, gender, coronary artery calcification score >0, hypertension, current smoking, moderate/severe alcohol abuse, and body mass index. The proportion of human immunodeficiency virus (HIV)-negative persons in the matched dataset is shown in blue and the HIV-positive persons are shown in red. The brighter colors represent the patients in the matched dataset without incidental findings, and the darker colors represent the patients with incidental findings. The *P* value corresponds to the association between incidental findings and HIV infection from the conditional logistic regression with matched HIV positive-HIV negative pairs.

Likewise, in the same propensity score-matched dataset, there was no evidence for higher prevalence of clinically relevant findings among HIV-infected individuals (10 of 151 [6.6%] in the HIV-positive population vs 13 of 151 [8.6%] in the matched HIV-negative population; $P = .514$).

Associations Between Human Immunodeficiency Virus-Related Variables and Incidental Findings

In an analysis restricted to the HIV-positive participants, additionally years on ART (OR, 1.28 per 5 years; 95% CI, 1.01–1.64) was associated with incidental findings. CD4 nadir did not exhibit a significant effect on incidental findings (OR, 1.09 per 100 cells/μL; 95% CI, 0.92–1.30), and neither did years of untreated HIV infection (OR, 1.11 per 5 years; 95% CI, 0.90–1.38) (Figure 3).

DISCUSSION

To our knowledge, this is the largest study investigating the prevalence of incidental findings in HIV-positive and HIV-negative persons undergoing CT imaging for assessment of subclinical coronary atherosclerosis. In more than half of 553 patients, we recorded incidental findings with 8 percent of participants having clinically relevant findings requiring further investigations or treatment. More importantly, HIV infection was not associated with the detection of incidental findings.

In the general population, the prevalence of incidental findings in CT scans performed for CAC score or CCTA was reported to be 13%–53% (reviewed in [9]). In our HIV-positive

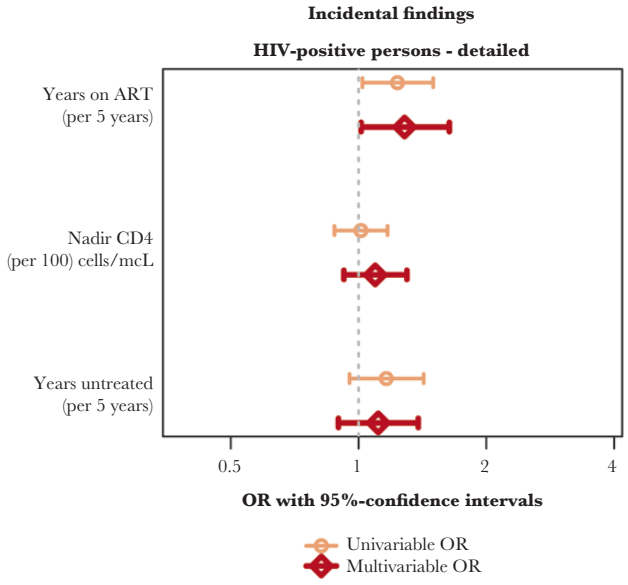

Figure 3. Associations between human immunodeficiency virus (HIV)-specific variables and incidental findings. Analyses are based on 247 incidental findings in 341 HIV-positive persons. The results from the multivariable analysis are adjusted for the variables listed on the left side in addition to age, gender, current smoking, hypertension, body mass index, and coronary artery calcification score >0. ART, antiretroviral therapy; OR, odds ratio.

group, we found a prevalence of 48%. Data among HIV-positive individuals undergoing cardiac imaging is limited. In 2 other HIV cohorts, incidental findings on CCTA were investigated with recorded prevalence of 43% and 57% [11, 12]. In both studies, patients were substantially younger (median age 43 years and 46 years, respectively) compared with our HIV-positive population (median age 52 years). The study with the lower prevalence of CT abnormalities included only 15% current smokers [11], whereas in the other study [12] 63% of the participants smoked compared with 35% in our study. In addition, other differences of participant characteristics, including demographics and alcohol and drug use, might explain the variation in prevalence of unexpected findings [11, 12, 17].

In our HIV-negative comparison group, incidental findings were detected more often (60%) compared with the HIV-positive group (48%). The HIV-negative participants were slightly older, more often had hypertension and a positive CAC score, and were referred for cardiac imaging because of clinical symptoms, in contrast to our asymptomatic HIV-positive participants. To overcome the effect of heterogeneity, we compared the HIV-positive group with a propensity score-matched HIV-negative control group. Thereby, we showed that HIV infection had no significant impact on the prevalence of unexpected findings. Because HIV-positive patients are regularly seen by clinicians (in the SHCS every 3 to 6 months), the chance to have diagnostic procedures with the detection of findings may be higher than in the age-matched general population without regular medical visits. We believe that this is an important reason that, in our study, the prevalence of incidental (not yet detected) findings was lower in the HIV-positive group than in the HIV-negative group. Our results are in line with results from the Examinations of HIV Associated Lung Emphysema (EXHALE) Study in which HIV infection was not associated with abnormal findings on chest CT for lung cancer screening in asymptomatic participants with CD4 cell counts >200 cells/μL [18]. This indicates that although HIV-infected individuals are presumed to be affected by chronic inflammation and an increased risk of age-related disease, there is no excess risk of incidental findings on CCTA.

Increasing age was a strong predictor for incidental findings in both of our groups, in accordance with previous studies of the general and HIV-infected population [9, 11–13]. Smoking was an independent risk factor only in HIV-positive individuals. This might be due to the fact that pulmonary findings, particularly emphysema, were more frequent in the HIV-positive compared with HIV-negative patients. A positive CAC score was associated with incidental findings in HIV-negative participants; similar risk factors for both conditions, not assessed in the analyses, might explain this association, as shown by others [11].

Years on ART, probably a surrogate marker for HIV duration, was predictive for an increased risk of incidental findings among the HIV-positive group (HIV duration was not included in the multivariable model because of being collinear with time on ART and time off ART). A longer duration of HIV infection might be associated with a greater risk of previous pulmonary infections resulting in pulmonary nodules, scarring, and atelectasis. Moreover, cumulative antiretroviral toxicity might have contributed, but this remains speculative. In our study, a lower CD4 cell nadir was not associated with incidental findings, in contrast to Park et al [12].

The strengths of our study include the use of a large number of HIV-positive and HIV-negative participants including individuals of both genders. We were able to compare incidental findings on CCTA between HIV-positive and a well matched HIV-negative group. Our study has potential limitations. The 2 groups were heterogeneous in terms of demographic and clinical characteristics. Therefore, we used a propensity score-matched comparison cohort for the analysis of the HIV effect to minimize potential confounding. Our results might not be applicable to other HIV populations because most of our participants were in relatively good health, with a low rate of alcohol and drug use, on ART, virally suppressed, and received regular medical consultations in the setting of a well established observational study, the SHCS.

CONCLUSIONS

In conclusion, we showed that CCTA, a promising imaging tool to diagnose subclinical atherosclerosis in patients with increased cardiovascular risk including HIV infection, was associated with a remarkable rate of incidental findings. These

included clinically significant findings that had implications for patient care and were associated with significant additional expenses. However, HIV infection was not associated with an increased risk of incidental findings.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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The data are gathered by the Five Swiss University Hospitals, 2 Cantonal Hospitals, 15 affiliated hospitals, and 36 private physicians (listed in http://www.shcs.ch/180-health-care-providers).

Members of the SHCS. Anagnostopoulos A., Battegay M., Bernasconi E., Böni J., Braun D.L., Bucher H.C., Calmy A., Cavassini M., Ciuffi A., Dollenmaier G., Egger M., Elzi L., Fehr J., Fellay J., Furrer H., Fux C.A., Günthard H.F., Haerry D., Hasse B., Hirsch H.H., Hoffmann M., Hösli I., Huber M., Kahlert C., Kaiser L., Keiser O., Klimkait T., Kouyos R.D., Kovari H., Ledergerber B., Martinetti G., Martinez de Tejada B., Marzolini C., Metzner K.J., Müller N., Nicca D., Paioni P., Pantaleo G., Perreau M., Rauch A., Rudin C., Scherrer A.U., Schmid P., Speck R., Stöckle M., Tarr P., Trkola A., Vernazza P., Wandeler G., Weber R., Yerly S.

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References

1. Deeks SG, Lewin SR, Havlir DV. The end of AIDS: HIV infection as a chronic disease. Lancet **2013**; 382:1525–33.
2. Huber M, Ledergerber B, Sauter R, et al. Outcome of smoking cessation counselling of HIV-positive persons by HIV care physicians. HIV Med **2012**; 13:387–97.
3. Rasmussen LD, Helleberg M, May MT, et al. Myocardial infarction among Danish HIV-infected individuals: population-attributable fractions associated with smoking. Clin Infect Dis **2015**; 60:1415–23.
4. Hunold P, Schmermund A, Seibel RM, et al. Prevalence and clinical significance of accidental findings in electron-beam tomographic scans for coronary artery calcification. Eur Heart J **2001**; 22:1748–58.
5. Schragin JG, Weissfeld JL, Edmundowicz D, et al. Non-cardiac findings on coronary electron beam computed tomography scanning. J Thorac Imaging **2004**; 19:82–6.
6. Horton KM, Post WS, Blumenthal RS, Fishman EK. Prevalence of significant noncardiac findings on electron-beam computed tomography coronary artery calcium screening examinations. Circulation **2002**; 106:532–4.
7. Burt JR, Iribarren C, Fair JM, et al. Incidental findings on cardiac multidetector row computed tomography among healthy older adults: prevalence and clinical correlates. Arch Intern Med **2008**; 168:756–61.
8. Elgin EE, O'Malley PG, Feuerstein I, Taylor AJ. Frequency and severity of "incidentalomas" encountered during electron beam computed tomography for coronary calcium in middle-aged army personnel. Am J Cardiol **2002**; 90:543–5.
9. George A, Movahed A. Recognition of noncardiac findings on cardiac computed tomography examination. Rev Cardiovasc Med **2010**; 11:84–91.
10. Husmann L, Tatsugami F, Aepli U, et al. Prevalence of noncardiac findings on low dose 64-slice computed tomography used for attenuation correction in myocardial perfusion imaging with SPECT. Int J Cardiovasc Imaging **2009**; 25:859–65.
11. Crum-Cianflone N, Stepenosky J, Medina S, et al. Clinically significant incidental findings among human immunodeficiency virus-infected men during computed tomography for determination of coronary artery calcium. Am J Cardiol **2011**; 107:633–7.
12. Park MS, Hileman CO, Sattar A, et al. Incidental findings on chest computed tomography are common and linked to inflammation in HIV-infected adults. Antivir Ther **2017**; 22:127–33.
13. Loy A, Morgan R, O'Dea S, et al. Clinically significant extra-cardiac findings in asymptomatic HIV-positive men undergoing cardiac magnetic resonance imaging. Int J STD AIDS **2015**; 26:346–51.
14. Schoeni-Affolter F, Ledergerber B, Rickenbach M, et al. Cohort profile: the Swiss HIV Cohort study. Int J Epidemiol **2010**; 39:1179–89.
15. MacMahon H, Austin JH, Gamsu G, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. Radiology **2005**; 237:395–400.
16. Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol use disorders identification test. Arch Intern Med **1998**; 158:1789–95.
17. Eckard AR, Jiang Y, Debanne SM, et al. Effect of 24 weeks of statin therapy on systemic and vascular inflammation in HIV-infected subjects receiving antiretroviral therapy. J Infect Dis **2014**; 209:1156–64.
18. Sigel K, Wisnivesky J, Shahrir S, et al. Findings in asymptomatic HIV-infected patients undergoing chest computed tomography testing: implications for lung cancer screening. AIDS **2014**; 28:1007–14.